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Influence of canopy traits on spatio-temporal variability of throughfall in Mediterranean Downy oak and Scots pine stands

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The spatio-temporal variability of throughfall is the result of the interaction of biotic factors, related to the canopy traits, and abiotic factors, linked to the meteorological conditions. This variability may lead to significant differences in the volume of water and solutes that reach the ground in each location, and beyond in the hydrological and biogeochemical dynamics of forest soils.

Two forest stands in Mediterranean climatic conditions were studied to analyse the role of biotic and abiotic factors in the temporal and spatial redistribution of throughfall. The monitored stands are a Downy oak forest (Quercus pubescens) and a Scots pine forest (Pinus sylvestris), both located in the Vallcebre research catchments (NE Spain, 42º 12'N, 1º 49'E). The study plots are representative of Mediterranean mountain areas with spontaneous afforestation by Scots pine as a consequence of the abandonment of agricultural terraces, formerly covered by Downy oaks. The monitoring design of each plot consisted of a set of 20 automatic rain recorders and 40 automatic soil moisture probes located below the canopy. 100 hemispheric photographs of the canopy were used to place the instruments at representative locations (in terms of canopy cover) within the plot. Bulk rainfall, stemflow and meteorological conditions above the forest cover were also automatically recorded. Canopy cover as well as biometric characteristics of the plots were also regularly measured.

The results indicate a temporal persistence of throughfall in both stands, as observed elsewhere. However, for the oak plot the seasonal evolution of canopy traits added additional variability, with higher variability in summer and different locations of wet and dry spots depending on the season. Furthermore, this work investigates the influence of canopy structure on the spatial variability of throughfall by analysing a large set of forest parameters, from main canopy traits to detailed leaves and wood characteristics. The analysis includes the consideration of the interaction of main abiotic factors with canopy traits.